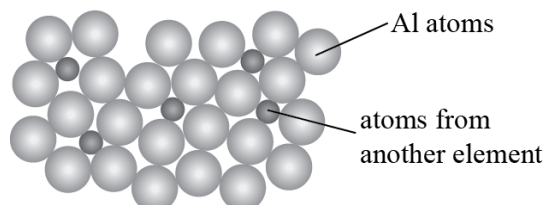


ANSWERS: Alloys

1) Aluminium is very low density, so good for reducing mass of aircraft, but it is quite soft and easily broken. Alloying it with another metal will make it harder because the atoms of the two different metals will be a different size; so the metal becomes less malleable and harder as well, as the particles will not be able to easily slide over each other, and therefore more durable for the purpose of flight.

A labelled diagram would be suitable as part of the answer.



2) Surgical steel is used because as an alloy, it has a mixture of metals / elements in it that give it desired characteristics.

Body piercing jewellery needs to be sterile, shiny, malleable and unreactive.

The chromium in the alloy will provide the shiny appearance of the metal (lustre) and provides scratch and corrosion resistance.

The nickel provides a smooth finish and corrosion resistance.

The molybdenum provides extra hardness and corrosion resistance to the alloy.

Each of the metals adds corrosion resistance to the alloy. This is important so that the jewellery doesn't corrode / react in someone's nose / mouth / belly button area and remains something that is easily sterilised / cleaned.

Steel / Iron is malleable as are other metals so it can be shaped into jewellery but with the Mo and Ni, it remains hard and will not break due to high tensile strength.

It has a high melting point so will withstand temperatures that may be reached by human activities.

Although iron has lustre, Nickel and Chromium provide a shininess and high lustre in the alloy so that the jewellery remains shiny and aesthetically pleasing

3. Silver is an attractive metal that is a lustrous white and malleable so can be turned into jewellery or other precious objects.

Silver is quite unreactive, so will not readily react with oxygen in the air, water, food or beverages, making it useful to use in jewellery or other precious objects.

Sterling silver is an alloy made up of mostly silver (92.5%) and some copper (7.5%). Silver is attractive and lustrous white in colour. It has a high melting point (962°C) but is not very hard (2.5 on the Moh scale of hardness). Copper is also an attractive metal but pink-brown in colour. Copper has a higher melting point than silver (1084°C) and is a little harder (3.0 on Moh's scale). Neither metal readily reacts with acid but silver is less reactive than copper.

Advantages of sterling silver over pure silver:

- Alloy is stronger / harder because the copper atoms are smaller than the silver ones so the atoms don't move across each easily as the atoms in pure silver metal can, making sterling silver stronger / harder than pure silver. (Silver is more expensive than copper so using an alloy with 92.5% silver compared to pure silver is cheaper – not linked to a property, so cannot be used as evidence for A, M or E.)

Disadvantages of sterling silver over pure silver:

- Alloy is more brittle and / or more difficult to shape / bend than the pure metal because the atoms in an alloy can't move across each other as easily as those in a pure metal. (Less malleable and ductile than pure silver.)

Since copper is more reactive than silver, by adding it to silver as an alloy it will make the alloy less resistant to corrosion than the pure metal. (The copper will oxidise more readily.)

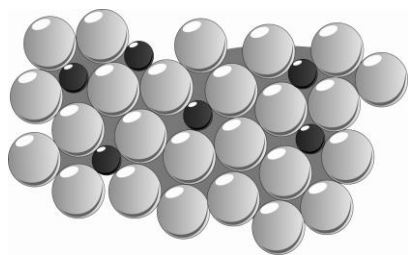
4. An alloy is a metal made by combining two or more elements (usually metals) to give improved properties such as greater strength or greater resistance to corrosion.

The structure of a metal would show the atoms are neatly packed together. The atoms can slide past each other relatively easily. This makes the metal malleable so it can be shaped without breaking. By alloying this metal, another element has been added and its atoms do not sit neatly within the metal structure. Now these atoms are not easily able to slide across each other so the metal is harder and it is not as easy to change its shape.

5. Hardness of an alloy:

Alloys contain atoms of different sizes, which distort the regular arrangements of atoms. This makes it more difficult for the layers to slide over each other, so alloys are harder than the pure metal.

A diagram that represents the arrangements of atoms in an alloy is shown below



Usefulness of the alloys:

The two alloys are more useful to jewellers than pure gold because pure gold is too soft and would readily deform under pressure.

Preferences:

18K gold is a richer more golden colour than 9K, and it is more durable than 24K, making 18K yellow gold the more popular choice for wedding rings.

9K is harder than 18K gold and more difficult to bend (less malleable) so 9K gold is more suitable for delicate jewellery.